



## *Burnt lime sludge*

# Available lime

### 1 Scope and field of application

This SCAN-test Method specifies a method for the determination of available lime in burnt (reburnt) lime sludge. The procedure is based on that specified in ASTM C-25 and should give equivalent results.

### 2 Definition

2.1 *Available lime*: An arbitrary measure, describing the content of such calcium oxide that enters into reaction under the conditions specified in this Standard. The result is expressed as a percentage of the mass of the sample as taken.

Note – Magnesium oxide may be present in lime. Under the conditions of this test only a few percent thereof enters into reaction.

### 3 Principle

The burnt lime sludge is ground to a fine powder and slaked with distilled water. Sucrose is added to accelerate the dissolution of calcium hydroxide. The resulting alkaline solution is titrated with hydrochloric acid and the amount of acid consumed is used to calculate the percentage of available lime.

### 4 Reagents

4.1 *Carbon dioxide-free distilled water*. Prepare by boiling distilled water. Allow to

cool in a stoppered bottle. Prepare a new batch each day samples are analysed.

4.2 *Sucrose*,  $C_{12}H_{22}O_{11}$ . Sucrose (sugar) in granular form for domestic use is normally acceptable. Check for acidity by titrating an aqueous solution, made from 15 g of the sugar, with 0,1 mol/l sodium hydroxide solution, using phenolphthalein as the indicator. If more than 0,1 ml is required to produce a pink colour, the sugar contains acids and should not be used for this test.

4.3 *Hydrochloric acid*, standardized ca 1 mol/l. The concentration should be known to the nearest 0,001 mol/l.

4.4 *Phenolphthalein indicator solution*, 0,1 %. Dissolve 0,1 g of phenolphthalein in 100 ml of ethanol,  $C_2H_5OH$ .

### 5 Preparation of sample

Samples should be protected from exposure to air and should be analyzed with a minimum of delay.

Break up any lumps and obtain a representative sample of about 75 g. Grind this portion in a mill or equivalent, avoiding undue exposure to air, until it passes a sieve with a nominal sieve opening of 150  $\mu m$ . Then thoroughly mix the ground material and place it in an airtight container.

**6 Procedure**

Carry out this procedure with duplicate samples.

Pour about 10 ml of distilled water, free from carbon dioxide, in a 300 ml conical flask.

Weigh a 0,5 g portion of prepared sample to the nearest 1 mg and carefully brush it into the flask. Stopper the flask immediately.

Disperse the sample thoroughly in the water by a swirling motion.

Remove the stopper and place the flask on a hot plate and immediately add 150 ml of boiling carbon dioxide-free water. Swirl the flask and boil actively for 1 min to achieve complete slaking.

Remove the flask from the hot plate, stopper it loosely and place it in a cold water bath to cool it to room temperature.

Add 15 g of sucrose, stopper the flask, swirl, and allow it to stand for 15 min to react. Swirl at 5 min intervals during the reaction period. Alternatively a magnetic stirrer may be used.

Note – The amounts of water and sugar to be used are only approximate. To save time, a small measure can be used, which when full holds 15 g of the sugar used.

Remove the stopper, add 4 to 5 drops of the phenolphthalein indicator solution. Wash down the stopper and the sides of the flask with carbon dioxide-free water.

Titrate rapidly with the standardized hydrochloric acid. Swirl the flask or stir the solution during the entire titration. When the first complete disappearance of the pink colour is observed, read the end point. Ignore the return of the pink colour.

Note – Unless the operator is familiar with a previous analysis of the lime under test, it is good practice to carry out a preliminary titration.

**7 Calculation**

Calculate the percentage of available calcium oxide from the expression

$$X = \frac{2,8 \cdot a \cdot c}{w}$$

where

- a* is the volume, in milliliters, of hydrochloric acid consumed in the titration,
- c* is the concentration of hydrochloric acid in moles per litre,
- w* is the amount of sample, analysed as taken, in grams,
- X* is the content of available calcium oxide as a percentage.

The numerical factor contains the relative molar mass of 0,5 moles of calcium oxide, 28,0, and the factor 0,1 necessary to convert the result to percentage units.

**8 Precision**

A sample of burnt lime sludge was analysed by this procedure by 8 laboratories. The mean value obtained was 84,5 %. None of the results were excluded. The relative standard deviation (coefficient of variation) was 1,0 %. The 95 % confidence limits were  $\pm 2,0$  %.

**9 Report**

Report the result as a percentage to the first decimal place. Report each result separately.

The test report should include a reference to this Method and the following particulars:

- a) date and place for testing,
- b) identification mark of the sample analysed,
- c) the results,
- d) any departure from this Method or any other circumstances that may have affected the results.